FINANCIAL FIREWALLS: THE CREDIT CRISIS AND NETWORK CONTAGION

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I. INTRODUCTION

The credit crisis highlights fundamental changes in financial markets that have significant implications for financial industry risk management and regulation. Contemporary financial markets are increasingly characterized by pervasive trading by many market participants.[1] Technological and financial innovations in recent years have contributed to the development of pervasive trading cultures. For example, trading in over-the-counter (OTC) derivatives and other innovative financial products has fundamentally transformed financial markets.[2] OTC derivatives have also enabled greater connectivity and linkages among financial market participants, sectors, and products.[3] Technological innovations have facilitated the development of pervasive global networks in which financial market participants are linked through OTC derivatives

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[1] *See generally* Olufunmilayo B. Arewa, *Trading Places: Securities Regulation, Market Crisis, and Network Risk* (Nw. Univ. Sch. of Law Pub. Law and Legal Theory Series, Paper No. 09-01, 2009) (manuscript on file with author), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1324951# (follow "Download" hyperlink; then select download location).

[2] OTC derivatives contracts, which include swaps and forwards, are traded through customized and private contracts between parties that are typically based on International Swap and Derivatives Association (ISDA) form agreements. In contrast, exchange-traded derivatives, which include futures and options on futures, are traded on organized derivative exchanges (ODEs), such as the Chicago Mercantile Exchange, and are traded and cleared through standardized contracts bought and sold in ODE markets. *Id.* at 24.

[3] MOHAMED EL-ERIAN, WHEN MARKETS COLLIDE: INVESTMENT STRATEGIES FOR THE AGE OF GLOBAL ECONOMIC CHANGE 141 (2008) (noting that OTC derivatives have "enabled to a far greater degree of linkage across markets than at any other time.").

contracts and other financial arrangements such as repurchase (repo) agreements.[4]

The volume of OTC derivatives reflects their broader financial and economic significance. In December 2008, an estimated $592 trillion in notional value of OTC derivatives was outstanding, a decrease of 13.4% from $683.7 trillion in June 2008.[5] Although the notional amount does not reflect true risk exposure, it does represent one measure of market size that is used as a reference point for determining contractual payments.[6] The gross market value of OTC derivatives, a better measure of risk, was $20.4 trillion in June 2008, close to one-third of global gross domestic product (GDP) and larger than the GDP of any single country in the world.[7] Despite the decline in notional values in December 2008, gross market value of OTC derivatives increased by 66.5% to $33.9 trillion, which constituted a significantly larger share of global GDP.[8]

The confluence of technological innovation and OTC derivatives has enabled the creation of vast global networks that have substantially altered the sources and nature of financial market risk.[9] Global financial market networks have become increasingly complex, as multiple webs of interconnections may link market participants through varied financial market products. The complexity of financial market networks makes risk management increasingly challenging.[10] The unfolding of the credit crisis that emerged in 2007 and 2008 illustrates the importance of risk management as a key factor in the containment of the spread of financial market crises. The credit market crisis also demonstrates how ineffective

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[4] Arewa, *supra* note 1, at 16-17.

[5] BANK FOR INT'L SETTLEMENTS (BIS), OTC DERIVATIVES MARKET ACTIVITY IN THE FIRST HALF OF 2008 1 (Nov. 2008), *available at* http://www.bis.org/publ/otc_hy0811.pdf; BIS, OTC DERIVATIVES MARKET ACTIVITY IN THE SECOND HALF OF 2008 1 (May 2009), *available at* http://www.bis.org/publ/otc_hy0905.pdf?noframes=1.

[6] *Id.* at 4.

[7] Central Intelligence Agency (CIA), WORLD FACTBOOK—EUROPEAN UNION ECONOMY—OVERVIEW 2, *available at* https://www.cia.gov/library/publications/the-world-factbook/geos/ee.html (estimating EU GDP as $14.66 trillion in 2007); Bureau of Economic Analysis, U.S. DEP'T OF COMMERCE, GROSS DOMESTIC PRODUCT: FOURTH QUARTER 2007 (FINAL) 8,T. 3, *available at* http://www.bea.gov/newsreleases/national/gdp/2008/pdf/gdp407f.pdf (reporting U.S. GDP as an estimated $13.8 trillion in 2007).

[8] BIS (May 2009), *supra* note 5, at 1; BIS (Nov. 2008), *supra* note 5, at 4.

[9] *See generally* Arewa, *supra* note 1.

[10] COUNTERPARTY RISK MGMT. POLICY GROUP III, CONTAINING SYSTEMIC RISK: THE ROAD TO REFORM 4 (2008) (noting that due to structural, technological, and behavioral reasons contemporary finance has become incredibly complex), *available at* http://www.crmpolicygroup.org/docs/CRMPG-III.pdf.

financial market firewalls can lead to a network failure, evident in the spread of cascading market crises through existing financial market networks.[11] In this manner, financial contagion has spread to other market participants, products, and activities, including the venture capital sector, which some thought would have relative immunity to credit crisis financial contagion.[12]

II. THE CREDIT CRISIS AND NETWORK CONTAGION

A. *The Credit Crisis and Risk: Origins and Impact*

The credit market crisis that emerged in 2007 and 2008 reflects a persistent mispricing of risk, particularly liquidity risk, with an initial focal point in the subprime residential mortgage market segment. More specifically, assumptions made about the presence of liquid markets for complex derivative securities led many market participants to make insufficient and even incorrect assumptions about the assets included on their balance sheets.[13] Primary markets for subprime mortgages expanded markedly in the early 2000s, facilitated by creative loans to a wide variety of borrowers, including those with weaker credit.[14] Subprime mortgages were packaged into a broad range of derivative securities, including Mortgage Backed Securities (MBS) and other Asset Backed Securities (ABS), as well as Collateralized Debt Obligations (CDOs) and Structured Investment Vehicles (SIVs), which in some instances reflected a double

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[11] FED. RES. BANK OF NEW YORK, PAYMENT RISKS SUBCOMM, FED. FINANCIAL MARKET INFRASTRUCTURE RISK 7 (May 2007) (describing systemic risk as risk that comes about due to linkages in financial market infrastructures, and noting that defaults in those infrastructures "can have a 'domino' effect on another network resulting in a cascading series of defaults and failures, even across markets, regions or globally.").

[12] BRONWYN DYLLA BAILEY & AARON GERSHENBERG, SVB CAPITAL: VENTURE CAPITAL UPDATE, VENTURE CAPITAL IN UNCERTAIN TIMES: OBSERVATIONS AND PREDICTIONS 1 (Nov. 2008) *available at* http://www.svb.com/pdfs/vc_2008_nov.pdf.

[13] *Confessions of a Risk Manager*, ECONOMIST, Aug. 7, 2008, at 72 ("Liquidity risk was in effect not priced well enough; the market always allowed for it, but at only very small margins prior to the credit crisis . . . The gap in our risk management only opened up gradually over the years with the growth of traded credit products such as CDO tranches and other asset-backed securities. These sat uncomfortably between market and credit risk.").

[14] Kristopher Gerardi, Adam Hale Shapiro & Paul S. Willen, *Subprime Outcomes: Risky Mortgages, Homeownership Experiences, and Foreclosures* 6 (Fed. Res. Bank of Boston, Working Paper 07-15, Dec. 3, 2007).

securitization process.[15] Primary markets for subprime mortgages and residential mortgages more generally have been significantly influenced by secondary market infrastructures that were created in order to facilitate primary market residential housing finance.[16] Secondary market infrastructures had a significant impact on primary market loan issuances because they created liquid markets for securitized residential home mortgages. This was particularly true in the early 2000s, when the ability of lenders financing residential home purchases in primary markets to sell the loans they originated in secondary markets contributed to a decline in credit standards.[17] Subprime lenders thus financed their businesses through secondary market sales.[18]

During the early 2000s, mortgage loan origination and securitization practices reflected widespread inattention to and even mispricing of risk.[19] Risks in primary markets for loan origination spread to other financial market segments and broader markets as a dense web of financial market networks, involving a broad range of financial products, including OTC derivatives. Many such derivative securities were priced with insufficient attention to the implications of declines in residential housing prices.[20] Further, CDOs that included exposure to home mortgage assets incorporated assumptions about defaults and other variables that were based on historical data.[21] Price declines in residential housing

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[15] Richard J. Rosen, *The Role of Securitization in Mortgage Lending*, CHICAGO FED LETTER NO. 244 (Nov. 2007).

[16] *Subprime Mortgage Market Turmoil, Examining the Role of Securitization: Hearing Before the S. Subcomm. on Securities, Insurance, and Investment*, 110th Cong. (2007) (statement of Christopher L. Peterson, Associate Professor of Law, University of Florida).

[17] Andreas A. Jobst, *Unscathed Securitization: Emerging Market CDOs After the US Sub-Prime Mortgage Crisis*, GLOBAL SECURITISATION AND STRUCTURED FIN. 8, 9 (2008).

[18] Gary B. Gorton, *The Subprime Panic* 7 (Nat'l Bureau of Econ. Research, Working Paper No. 14398, Oct. 2008), at 7, *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1276047 (noting that subprime originators financed their business through securitization was the main finance mechanism for subprime originators).

[19] Jobst, *supra* note 17, at 9.

[20] Michael Lewis, *The End*, PORTFOLIO.COM 5, Nov. 11, 2008, http://www.portfolio.com/news-markets/national-news/portfolio/2008/11/11/The-End-of-Wall-Streets-Boom/index4.html (noting that an S&P representative disclosed that its models for home prices did not have the ability to accept a negative number to reflect declining home prices).

[21] COUNTERPARTY RISK MANAGEMENT POLICY GROUP III, *supra* note 10, at 53 (noting that the characteristics and risk of loss associated with CDOs and other structured products "were not fully understood by many market participants," which reflected varied factors, "including a lack of understanding of the inherent limitations of valuation models and the risks of short-run historical data sets").

markets led to an increase in mortgage defaults.[22] The increase in mortgage default rates led to serious valuation problems for derivative securities held on many balance sheets that had exposure to residential real estate assets.[23] The complex and networked relationships binding participants in subprime and other market sectors contributed to the credit crisis, because the nature of risks were not transparent, leading to a liquidity crisis when participants began to hoard cash because of uncertainties about the liquidity of other market participants.[24] Problems quickly spread to institutions involved in residential housing finance secondary markets, including Freddie Mac and Fannie Mae, which pool mortgages and guarantee against credit risk in the securitization process.[25] In addition, a broad range of financial institutions, like Lehman Brothers, Merrill Lynch and Citibank, held CDOs and other financial instruments that had exposure to residential housing markets on their balance sheets.[26] The complexity of at least some of the derivative instruments held by such financial institutions contributed to the collapse of liquidity in markets for complex derivative securities.[27] Further, the presence of such "toxic" assets on financial institution balance sheets contributed to the failure, forced sale, and continuing financial malaise at a wide range of entities throughout the world.[28]

B. *Financial Contagion: Network Effects and CDS Markets*

The spread of credit crisis contagion has not always been entirely predictable, in part due to incomplete understanding of market participants

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[22] Dana Heller, *Understanding the Economic Complexities of Loan Modification Programs*, at 1, Feb. 25, 2009, NERA Economic Consulting, http://www.nera.com/image/PUB_Loan_Modification_Program_0209.pdf ("The statistics on foreclosures and the effects of the decline in housing prices on the equity of those homeowners are staggering. The rapid depreciation in housing prices has already left millions of homeowners with negative equity on their houses.").

[23] Felix Salmon, *Explaining CDOs, Overcollateralization Edition*, PORTFOLIO.COM, Dec. 28, 2007, http://www.portfolio.com/views/blogs/market-movers/2007/12/28/explaining-cdos-overcollateralization-edition/ (noting the impact of higher default rates in underlying mortgages for payouts to CDO investors).

[24] Gorton, *supra* note 18, at 1.

[25] OFFICE OF FED. HOUSING ENTERPRISE OVERSIGHT (OFHEO), SYSTEMIC RISK: FANNIE MAE, FREDDIE MAC AND THE ROLE OF OFHEO 45, (Feb. 2003) (describing the Fannie Mae and Freddie Mac business models); Bethany McLean, *Fannie Mae's Last Stand*, VANITY FAIR, Feb. 2009.

[26] John Cassidy, *Subprime Suspect*, NEW YORKER, March 31, 2008, at 78.

[27] COUNTERPARTY RISK MANAGEMENT POLICY GROUP III , *supra* note 10, at 53.

[28] Gorton, *supra* note 18, at 1-2, 20-27.

and regulators about the composition of financial market networks. For example, Credit Default Swaps (CDS) have been important constituent elements in the pervasive financial networks through which credit crisis financial contagion has spread.[29] CDS are nontransparent and largely unregulated OTC derivatives contracts in which one party (the protection seller) guarantees payment of a fixed-income security to another party (the protection buyer).[30] In exchange, the protection buyer pays the protection seller a payment (usually on a quarterly or semiannual basis).[31] The notional and market value of CDS contracts expanded astronomically in the ten years preceding the credit crisis, with notional values rising from $180 million in 1997 to $57 trillion in notional value ($3 trillion in market value) in June 2008, with a decline in notional value in December 2008 to $41.9 trillion in notional value; although notional values decreased, market values increased significantly in December 2008 by 78.2% to $5.7 trillion.[32]

CDS exposure reveals the pervasive mispricing of risk that existed in multiple market arenas before the credit crisis. Further, CDS contracts written on CDOs exposed protection sellers to residential housing markets. The expansive growth in CDS contracts reflected speculative risk-taking on both sides of CDS transactions. Protection buyers were not required to own or purchase the underlying financial instrument being insured by the protection seller. As a result, CDS transactions became a cheap and easy vehicle for speculating on the health of a broad range of companies.[33] Protection sellers, who included traditional bond insurers as well as insurance companies such as American International Group, Inc. (AIG), began to issue insurance for increasing numbers of CDOs, which represented an expansion outside of traditional bond insurance arenas in the less risky world of municipal bonds.[34] Protection sellers did not correctly calculate the risk of their guarantees, which led to significant problems for the monoline bond insurers, as well as AIG.[35] AIG was a leading force in CDS protection selling, largely through its subsidiaries, particularly AIG

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[29] Laurence K. Eisenberg & Thomas H. Noe, *Systemic Risk in Financial Networks* 1 (Working Paper, 1999), *available at* http://ssrn.com/abstract=173249 (noting that financial markets reflect a "rich network of interconnections among firms.").

[30] Arvind Rajan, *A Primer on Credit Default Swaps*, THE STRUCTURED CREDIT HANDBOOK 17 (Arvind Rajan, Glen McDermott & Ratul Roy eds. 2007) (noting that tight corporate yields stimulated investor demand for tranched structured finance products).

[31] *Id.*

[32] BIS (Nov. 2008), *supra* note 5, at 1; BIS (May 2009), *supra* note 5, at 2.

[33] *Giving Credit Where It is Due*, ECONOMIST, Nov. 6, 2008 ("CDS contracts were worth $62 trillion at the peak, far more than the bonds the CDSs were insuring.").

[34] James Surowiecki, *Bonds Unbound*, NEW YORKER, Feb. 11, 2008, at 56.

[35] *Id.* (discussing implosion of the monolines); *Bond Insurers are Facing Downgrades*, N.Y. TIMES, Sept. 18, 2008, at 5.

Financial Products (AIGFP).[36] Miscalculations and the elimination of risk controls led to a mispricing of risk by AIG in CDS protection contracts, which contributed to AIG's need for a bailout from the federal government.[37]

A general inattention to risk thus led to significant failures in primary markets for residential housing finance, as well as a broad range of secondary markets in which participants and financial products had exposure to the residential housing primary markets. Troubles in these markets soon spread through financial market linkages to participants linked both directly and indirectly through financial market networks. For example, problems with bond insurers have had significant network effects that have infected markets for student loans and municipal bonds.[38]

The risk-related problems emerging from CDS transactions are magnified by their lack of transparency, which has contributed to systemic risk.[39] The impact of cascading network failure in different financial market arenas has also been exacerbated by the lack of effective firewalls that might contain instability. A wide range of market participants did not internalize the risk of their activities. Many also failed to maintain at sufficient levels capital cushions that might serve as a firewall during periods of market instability.[40] Thus, the credit crisis has had a significant

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[36] Robert O'Harrow Jr. & Brady Dennis, *Downgrades and Downfall*, WASH. POST, Dec. 31, 2008, at A01 (describing CDS activities at AIGFP).

[37] Liam Pleven, Sudeep Reddy & Carrick Mollenkamp, *AIG Bailout Hit by New Cash Woes*, WALL ST. J., Oct 9, 2008 (noting AIG problems with securities lending and credit default swaps); *Hearing Before the H. Comm. on Oversight and Government Reform*, 3-7, (2008) (statement of Maurice Greenberg), *available at* http://oversight.house.gov/documents/20081007101332.pdf (attributing AIG's need for a bailout to weakening or elimination of risk controls at AIGFP).

[38] *The State of the Bond Insurance Industry Before the H. Subcomm. on Capital Markets*, at 2, Feb. 14, 2008, Serial No. 110-91 (remarks of Chairman Kanjorski) (noting that bond insurer downgrades have led to limited availability of bond insurance, which has caused significant problems in student loan financing and municipal bond arenas, leading to some municipalities paying interest rates of more than 10% on outstanding short-term debts); Sylvan G Feldstein, Frank J. Fabozzi & Patrick M. Kennedy, THE HANDBOOK OF FIXED INCOME SECURITIES 197, 216-218 (Frank J. Fabozzi ed. 2001) (noting the importance of insurance in municipal bond context in reducing investor credit risk and expanding marketability of certain municipal bonds).

[39] John J. Schneider & Daniel S. Bender, *The Impact of Regulation on Credit Default Swaps* 2 (2008), Navigant Consulting (noting that the inability of regulators and the financial system to monitor CDS exposure has contributed to the systemic impact of the CDS market).

[40] Alan Greenspan, *Banks Need More Capital*, ECONOMIST, Dec. 18, 2008, at 122 (noting that in the aftermath of the credit crisis, investors will require banks and other intermediaries to have more capital).

and widening impact on a broad range of market participants, segments, and products.

C. *Network Regulation: Markets, Products, and Players*

The credit market crisis highlights failures in both industry risk management and financial market regulatory oversight. A continuing inability to recognize the importance of and appropriately regulate risk in pervasive trading networks is a common element of both industry and regulatory failures.[41] Financial market regulatory frameworks in the U.S. reflect an inconsistent patchwork of largely reactionary regulation pieced together over time.[42] These frameworks reflect industry structures of the past in which banking, securities, and insurance sectors were discrete market segments regulated by separate regulators. Although the separation among these sectors in the U.S. reflected regulatory requirements of Glass-Steagall,[43] which limited the ability of banks to own securities and insurance businesses, the elimination of Glass-Steagall restrictions in 1999 merely recognized the global business reality of convergence among financial market sectors.[44] Prior to the credit market crisis, U.S. regulatory frameworks formed a complex fabric of overlapping regulations by largely functional regulators. These regulatory frameworks continue to track categories of financial market business sectors that have long since ceased to exist in their original forms.[45]

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[41] *See generally* Arewa, *supra* note 1.

[42] Press Release, Dept. Treas., Under Secretary Steel Remarks on U.S. Financial Regulation, (Feb. 7, 2008) (describing U.S. regulatory frameworks as "largely knit together over the last 75 years – with act on top of act, initiative on top of initiative – each a reaction to various crises or innovations in the financial services industry").

[43] THE DEP'T OF THE TREAS., BLUEPRINT FOR A MODERNIZED FINANCIAL REGULATORY STRUCTURE, at 34, March 2008 (noting that four sections of the Banking Act of 1933, which was known as the Glass-Steagall Act, "mandated strict separation of commercial and investment banking"); James R. Barth, R. Dan Brumbaugh Jr. & James A. Wilcox, *The Repeal of Glass-Steagall and the Advent of Broad Banking*, (U.S. Treasury Economic and Policy Analysis Working Paper No. 2000-5) (noting that Glass-Steagall had prohibited bank holding companies from offering investment, commercial banking and insurance services).

[44] Loretta J. Mester, *Repealing Glass-Steagall: The Past Points the Way to the Future*, Phil Bus. Rev. (July-Aug. 1996).

[45] Steel, *supra* note 42 ("Today we have a series of individual regulations, each designed in response to specific circumstances and lacking an overarching set of guiding principles. Our system has multiple federal and state regulators with unclear and sometimes overlapping boundaries.").

The complexity and fragmentation of U.S. regulatory frameworks compromised their ability to confront questions of systemic risk,[46] which includes risks to financial market networks and the broader financial system.[47] Furthermore, fragmented regulatory frameworks were not equipped to regulate the pervasive financial market networks that have been facilitated in recent years by financial and technological innovations, particularly in the OTC derivatives arena.[48] The exemption of most OTC derivatives from regulation under the Commodity Futures Modernization Act of 2000 (CFMA) exacerbated the patchwork nature of regulatory coverage and contributed to a general lack of transparency in financial market networks.[49] This lack of transparency magnified the impact of the credit crisis because little understanding existed concerning the composition or structure of financial market networks.

Exemption of OTC derivatives from regulation under the CFMA was based on assumptions about the nature of sophisticated parties entering into OTC derivatives transactions. A 1999 President's Working Group (PWG) report made an influential case for non-regulation of OTC derivatives. The report specifically recommended that transactions involving sophisticated counterparties, including eligible swap participants that are otherwise subject to regulation, be excluded from regulation under the Commodity Exchange Act.[50] The 1999 PWG report reflects a fundamental distinction evident in federal regulatory frameworks, including securities and futures regulation, between public and private entities and market activities. Activities and entities that fall within the "public" sphere are generally subject to greater regulation, while those that fall within the "private" arena are typically subject to fewer regulatory registration and

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[46] Joel Seligman, *The United States Federal-State Model of Securities Regulation*, at 78, 84, Sept. 4, 2003, Research Study Prepared for the Wise Persons' Committee, Government of Canada, *available at* http://www.wiseaverties.ca/reports/WPC_3.pdf (describing US securities regulatory frameworks as Byzantine, and noting that regulators see advantages to having more regulators involved).

[47] Fed. Res. Bank of N.Y., *supra* note 11, at 7 (describing systemic risk as risk that comes about due to linkages in financial market infrastructures and that default in one such infrastructure "can have a 'domino' effect on another network resulting in a cascading series of defaults and failures, even across markets, regions or globally.").

[48] *Id.*

[49] P.L.106-554, 114 Stat. 2763 (2000) (amending Commodity Exchange Act 7 U.S.C §§ 1 et seq. (2006)).

[50] Presidents Working Group, OVER-THE-COUNTER DERIVATIVES MARKETS AND THE COMMODITY EXCHANGE ACT, at 2-3, Nov. 1999; Commodity Exchange Act 7 U.S.C §§ 1 et seq. (2006).

disclosure requirements, although activities in the "private" arena generally remain subject to anti-fraud liability.

The relatively light regulation of activities and entities that fall within the "private" segment is typically based on assumptions about the nature of participants in such market sectors, and the ability of such participants to protect themselves without the need for the protection of regulation.[51] However, this conception of regulation assumes that transactions in such markets are discrete, with a primary impact on participants in such transactions themselves and takes insufficient account of the potential impact of such activities on broader financial market networks, particularly in instances where market participants may not adequately internalize the risk of their activities. Despite regulation of entities that might engage in transactions involving significant risk, current regulatory frameworks do not sufficiently consider the reality of pervasive financial market networks that intersect and link the "public" and "private" market segments. Further, existing frameworks do not sufficiently take account of the systemic risk that may be engendered by activities within such networks. Securities and Exchange Commission (SEC) regulation of investment bank holding companies under its now terminated Consolidated Supervised Entity (CSE) program reflected significant inattention to issues of risk in CSE participating entities,[52] many of which became focal points in the creation and spread of financial market contagion.[53] Pre-credit crisis financial market regulation frameworks focused far too much on regulating entities and far too little on focusing on network effects. This lack of regulatory and industry attention to network effects is a key factor in the development and spread of the credit crisis.

The activities of venture capitalists (VCs) played little or no role in the development of the credit crisis. Venture capital typically functions in market sectors that are lightly regulated and, in many respects, represents a model for private market ordering that appropriately aligns incentives largely in the absence of external regulation.[54] Despite a lack of direct

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[51] SEC v. Ralston-Purina Co., 346 U.S. 119, 125 (1953) (establishing that the main consideration in determining availability of Section 4(2) private offering exemption is whether offerees are able to fend for themselves without need of the protection afforded by the Securities Act).

[52] SEC, Office of Inspector General, SEC's Oversight of Bear Stearns and Related Entities: The Consolidated Supervised Entity Program 7, Sept. 25, 2008, Report No. 446-A.

[53] Arewa, *supra* note 1, at 68-71.

[54] Ronald J. Gilson, *Engineering a Venture Capital Market: Lessons from the American Experience*, 55 STAN. L. REV. 1067, 1069 (2003) (describing private ordering as the keystone of the U.S. venture industry and describing private ordering as "the contracting structure that developed to manage the extreme

involvement in the activities that precipitated the credit crisis, venture capital is nonetheless experiencing a significant impact in the aftermath of the credit crisis. The impact of the credit market crisis in the venture capital arena illustrates the spread of financial contagion through financial market networks. The spread of contagion through network connectivity underscores the need for regulatory frameworks and industry risk management in the future that focus on mechanisms that create firewalls to contain the spread of contagion within entities responsible for creating risks that precipitated the financial crisis. [55]

III. THE CREDIT CRISIS AND VENTURE CAPITAL

A. *The Venture Capital Sector*

The impact of the credit crisis in the venture capital sector is noteworthy and reveals ways the credit crisis market contagion has spread through financial market networks to infect other market segments. Venture capital represents one segment of the private equity investment arena and has traditionally been a significant source of financing for entrepreneurial companies, which form an important sector in the broader U.S. economy. Venture capital investors typically invest in early stage companies with little or no revenues that are not yet profitable. [56] Venture capital investing involves significant risk, which leads venture capitalists to require a higher rate of return than other private equity investors. [57]

Venture investors, who may include wealthy private investors, often referred to as "angel investors," or institutional investors, typically own less than 50% of their portfolio companies. [58] Venture capitalists may work with founders or existing company management in developing strategies to commercialize a company's products and grow revenues to profitability. Although venture capital investors do not typically seek active control of companies, they typically retain significant control

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uncertainty, information asymmetry, and agency costs that inevitably bedevil early-stage, high-technology financing").

[55] Arewa, *supra* note 1, at 71-75.

[56] John C. McIlwraith, *The Outlook for the Private Equity Market*, 51 CASE W. RES. L. REV. 423, 424 (2001).

[57] *Id.* at 425 ("Venture investors generally seek a higher rate of return on their investments than do LBO investors—a five to ten times return on their investment versus a three to five times return. This difference reflects the much higher degree of risk involved in a venture investment.").

[58] *Id.* at 424.

mechanisms and may assert control when companies fail to meet performance objectives.[59]

The entrepreneurship fostered by venture capital is an important determinant in savings, investment and wealth inequality.[60] The influence of the venture capital sector thus extends far beyond companies that receive venture capital financing. Small businesses play a critical role in the U.S. economy, representing a significant and increasing proportion of U.S. economic activity, and account for approximately half of U.S. output and private sector employment.[61] Venture-backed companies, which are a small but influential portion of small businesses, are "among the crown jewels of the American economy."[62] Such companies are important economically, both on account on their involvement with cutting-edge scientific and technological innovation, as well as their status as "important engine[s] of macroeconomic growth and job creation."[63] The development of such companies and commercialization of their technology is heavily dependent on access to capital, particularly in the earlier stages of such companies' development, including seed and start-up phases.[64] In these early stages of development, private investors are often a major source of funding.[65]

The network effects of the credit market crisis have contributed to malaise in the venture capital and private equity arena more generally. The spread of credit market crisis contagion in the venture sector may limit access capital in important ways that may have broader effects within industry segments and geographic areas with strong connections to venture capital investment processes. In the venture capital arena, two primary network effects are evident. The first major impact of the credit crisis led to venture capitalists' having a reduced ability to exit their existing investments. The second network effect occurred on the investor side as a result of the stress that the credit crisis has placed on institutional investors,

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[59] *Id.* at 424-425.

[60] Marco Cagetti & Mariacristina De Nardi, *Taxation, Entrepreneurship, and Wealth*, Fed. Res. Bank of Minneapolis, Res. Dept. Staff Rep. 340, July 2004, at 1, *available at* www.minneapolisfed.org/research/sr/SR340.pdf.

[61] OFFICE OF ADVOCACY, U.S. SMALL BUS. ADMIN., THE SMALL BUSINESS ECONOMY: A REPORT TO THE PRESIDENT 5 (2004), *available at* http://www.sba.gov/advo/stats/sb_econ2004.pdf.

[62] Gilson, *supra* note 544, at 1068.

[63] *Id.*

[64] Jeffrey E. Sohl, *The US Angel and Venture Capital Market: Recent Trends and Developments*, 6 J. PRIV. EQUITY 16 (2003); William Aspray & J. McGrath Cohoon, *Access to Financial Capital: A Review of Research Literature on Women's Entrepreneurship in the Information*, National Center For Women & Information Technology Entrepreneurial Report Series 3 (2007), *available at* http://www.ncwit.org/pdf/3_final_access_to_capital.pdf.

[65] *Id.*

such as university endowments and pension funds that are significant investors in the venture capital arena.

B. *Exit Opportunities Foreclosed: IPO and M&A Markets in the Credit Crisis*

Although venture capitalists largely make investments in private companies that are not subject to federal regulatory registration or disclosure requirements, public markets have a significant impact on venture capital in a number of important ways. Well functioning capital markets are a critical aspect of venture capital investment strategies because such markets provide VCs with exit opportunities.[66] Although venture capital is a small segment of U.S. capital markets, its impact on capital markets is significant: in the eleven years ending in 1988, 30% of U.S. initial public offerings (IPOs) had venture backing.[67] This percentage has likely increased since 1988.[68] Typical VC exit avenues are initial public offerings (IPOs), private sales, or management buyout transactions.[69]

The credit market crisis negatively affected venture capital fund exit opportunities.[70] Broader market instability during the credit crisis led to a difficult environment for companies seeking to go public, and activity in global IPO markets was virtually frozen by the end of 2008. During the third quarter of 2008, for example, a total of five companies went public in the U.S. in transactions totaling $935 million, a decrease from thirty-nine companies and $12 billion in the same quarter in 2007.[71] Decreased IPO activity in the U.S. paralleled declines in other markets.[72] The freezing of

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[66] RICHARD L. SMITH & JANET KILHOLM SMITH, ENTREPRENEURIAL FINANCE 605 (2d ed. 2000).

[67] *Id.* at 470.

[68] *Id.* at 471.

[69] *Id.* at 497 (noting that venture investors harvest their investments in three principal ways: IPOs, private sales, and management buyouts); Phillip D. Torrence & Richard A. Walawender, *Legal Considerations in Exit Strategies: IPO vs. Sale*, PRIVATE EQUITY: HISTORY, GOVERNANCE, AND OPERATIONS 357 (Harry Cendrowski et al. eds. 2008) (describing private equity fund exit strategies as including sale of portfolio companies in an initial public offering or sale of the company's stock or assets to another).

[70] Claire Cain Miller, *Venture Capital Exit Drought Continues*, N.Y. TIMES Bits Blog, Oct. 1, 2008, http://bits.blogs.nytimes.com/2008/10/01/venture-capital-exit-drought-continues/.

[71] Lynn Cowan, *Pace of IPOs Globally Continues to Slow in Uncertain Climate*, WALL ST. J., Oct. 1, 2008, at C10.

[72] *Id.* (noting that Europe experienced a 78 percent decline in IPO issuers and 94 percent decline in IPO proceeds, China encountered a 62 percent decline in IPO issuers and 80 percent decline in IPO proceeds, and India also suffered similar declines, as did Latin America, where no IPOs came to market in the third quarter

global IPO markets was felt in the venture sector, where only seven venture-backed companies went public in the first three quarters of 2008 as compared with forty-eight companies in 2007.[73] Merger and acquisition (M&A) activity similarly declined in 2008, with transactions involving venture-backed companies declining from $34.1 billion to $22.3 billion in the first three quarters of 2008 as compared with 2007 and declining from $12.7 billion to $4.4 billion in the third quarters of 2008 and 2007.[74]

The network effects of the credit crisis that led to a freezing of IPO and M&A transactions have thus limited the ability of VCs to exit their investments. The inability of VCs to exit existing investments has placed pressure on both VCs and venture-backed companies. As a result, VCs may not be able to contribute to existing portfolio companies or make investments in new portfolio companies, which may lead to failures at a broad range of venture-backed companies.[75]

C. *Venture Capital Limited Partners: Institutional Investors and Liquidity Constraints*

Network effects of the credit crisis in the venture capital arena extend far beyond the ability of VCs to exit investments. Limited partner investors in venture capital funds have also experienced a significant impact from the credit crisis. The effects of the credit crisis for such investors have

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of 2008 and that although IPO issuers decline in the Middle East and North Africa during this same time period, IPO proceeds doubled in that region to $1.5 billion).

[73] Dow Jones Venture Wire, *Crisis Crushing Venture-backed IPO and M&A Activity*, Oct. 1, 2008, *available at* http://www.researchrecap.com/index.php/2008/10/01/crisis-crushing-venture-backed-ipo-and-ma-activity/ ("Only seven venture-backed companies have gone public so far this year, compared with 48 in the first three quarters of 2007.").

[74] *Id.*

[75] Henry Blodget, *Dear Investors and Portfolio Companies: We're Broke*, SILICON ALLEY INSIDER, Nov. 8, 2008, *available* at http://www.businessinsider.com/2008/11/dear-investors-and-portfolio-companies-we-have-no-cash; Eric Eldon, *More Details On Sequoia's Economic "Inconvenient Truth" Meeting*, VentureBeat.com, Oct. 9, 2008, http://venturebeat.com/2008/10/09/more-details-on-sequoias-economic-inconvenient-truth-meeting/ (describing a meeting held in October 2008 by premiere VC firm Sequoia in which Sequoia reportedly told its portfolio "to cut costs and prepare for an economic downturn that could last many years"); Ken Schachter, *Silicon Valley Goes Dry*, RedHerring.com, Oct. 1, 2008, http://www.redherring.com/home/25124 ("As with other segments of the economy, the global credit crisis is casting a dark shadow over venture-backed companies."); Julie Schmit, *Biotech Firms Face Cash Shortage*, USA TODAY, Nov. 24, 2008, at 8A ("Almost 40% of small and midsize public biotechnology companies in the U.S. are in danger of running out of cash within a year and government help is needed to encourage investment, industry leaders say.").

contributed difficulties for venture capital funds. Venture capital funds are typically structured as limited partnerships in which investors participate as limited partners (LPs).[76] The venture capitalists or managers of the venture capital fund are generally principals in a limited liability entity that serves as the venture fund's general partner (GP).[77] The GP has substantial control over venture capital fund activities and makes and monitors fund investments.[78] In the typical venture capital fund, limited partner investors in the fund contractually agree to contribute a certain amount to the venture fund (a "capital commitment"), but do not contribute the full amount at the time they make this commitment. LPs are typically required to make capital contributions to the fund whenever the GP issues a request for funds (a "capital call"). LPs are required to forward the requested funds when the GP makes a capital call.[79] Most private equity funds call 100 percent of committed capital within the first three or four years.[80]

The credit market crisis has entailed freezing of credit markets that has created significant liquidity problems for the institutional investors that are an important segment of venture capital fund investors.[81] The circumstances confronting university endowments during the credit crisis illustrate the types of liquidity constraints that potential venture fund LPs have faced. In recent years, university endowments have posted superior returns on their investments.[82] These returns have been largely due to investment strategies by university endowments that have allocated significant funds to the alternative investment arena, including private equity, venture capital funds, hedge funds, and other types of commonly illiquid investments.[83] University endowments play an important role in

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[76] Harry Cendrowski et al., PRIVATE EQUITY: HISTORY, GOVERNANCE, AND OPERATIONS 3, 5- 6 (Harry Cendrowski et al. eds. 2008).

[77] *Id.*

[78] Gilson, *supra* note 5462, at 1088 (noting that venture capital limited partnerships are virtually completely controlled by GPs).

[79] Cendrowski, *supra* note 76, at 6 (noting that LPs must adhere to GP capital calls).

[80] *Id.* at 24.

[81] Michael M. Grynbaum, *Signs Thawing Begins In Credit Flow; DOW Rises by 413*, N.Y. TIMES, Oct. 20, 2008, at A1, *available at* http://www.nytimes.com/2008/10/21/business/21markets.html?_r=1&ref=todayspaper ("Since the collapse of Lehman Brothers in mid-September, the credit markets entered a state of near paralysis, keeping many businesses and municipalities from obtaining financing.").

[82] Josh Lerner, Antoinette Schoar & Wan Wonsunwai, *Smart Institutions, Foolish Choices? The Limited Partner Performance Puzzle*, 62 J. FIN. 731, 733 (2007) ("The average returns of private equity funds that endowments invest in are nearly 21% greater than those of the average LP in our sample.").

[83] Josh Lerner, Antoinette Schoar & Jialan Wang, *Secrets of the Academy: The Drivers of University Endowment Success*, 22 J. ECON. PERSPECTIVES 207, 214

university operations, and many universities "rely heavily on income from their endowments."[84] Network effects of the credit crisis that froze liquidity for a wide range of market participants, combined with investment decisions by university endowments, have contributed to significant liquidity constraints on university endowments, which have contributed to financial distress at universities.[85]

During the initial stages of the credit crisis, a number of endowments had a shortage of cash, which led university endowments to attempt to sell private equity investments on the secondary market at what is thought to be a discount of at least 50 percent.[86] Universities have also been forced to make significant budget cuts in anticipation of declining payouts from endowments that have suffered significant declines in the values of their investment holdings.[87] Some university endowments also entered into transactions such as credit default swaps that magnified their exposure to markets and added to investment losses.[88] The problems

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(2008) (noting a shift by university endowments away from equities and fixed income investments toward sophisticated and often illiquid alternative assets); *Ivory-Towering Infernos*, ECONOMIST, Dec. 11, 2008, at 88, *available at* http://www.economist.com/finance/displaystory.cfm?story_id=12778077 (noting that Yale had a target of 2006 for investing 69 percent of its endowment in illiquid alternative asset classes such as hedge funds, private equity, property, and forests).

[84] Lerner, Schoar & Wang, *supra* note 83, at 207.

[85] John Hechinger & Craig Karmin, *Harvard Hit by Loss as Crisis Spreads to Colleges*, WALL ST. J., Dec. 4, 2008, at A1, *available at* http://online.wsj.com/article/SB122832139322576023.html; Claire Cain Miller & Geraldine Fabrikant, *Beyond the Ivied Halls, Endowments Suffer*, N.Y. TIMES, Nov. 26, 2008, at B1, *available at* http://www.nytimes.com/2008/11/26/business/26endowment.html (discussing university financial distress).

[86] Jonathan Keehner & Jason Kelly, *Harvard-Led Sale of Private-Equity Stakes Hits Values*, BLOOMBERG.COM, Dec. 1, 2008, http://www.bloomberg.com/apps/news?pid=20601109&sid=a0zdopFBGnbY&refer=home (describing 50 percent discounts in secondary market sales of Harvard private equity (LBO) investments); Felix Salmon, *Endowments Dump Private Equity Stakes*, PORTFOLIO.COM, Dec. 1, 2008, http://www.portfolio.com/views/blogs/market-movers/2008/12/01/endowments-dump-private-equity-stakes.

[87] *Ivory-Towering Infernos*, *supra* note 83 (noting that Stanford senior executives have taken 10% pay cuts); Miller & Fabrikant, *supra* note 85 (noting that university endowments are trying to sell private equity stakes on the secondary market to raise cash); *Harvard Borrows $2.5 Billion: The Costs and Rationale*, HARV. MAGAZINE.COM, Dec. 19, 2008, http://harvardmagazine.com/breaking-news/harvard-borrows-2.5-billion.

[88] Nathan Vardi, *Larry Summers' Debt Swap*, FORBES.COM, Feb. 20, 2009, http://www.forbes.com/2009/02/20/harvard-endowment-summers-business_summers_print.html (describing an interest rate swap entered into by Harvard that generated significant investment losses for Harvard).

experienced by venture capital fund LPs, such as university endowments, have contributed to venture capital fund problems in the credit crisis. These problems are both a consequence of broader market conditions and the structure of LP investment in venture capital funds. In the initial stages of the credit crisis, cash strapped investors refused to fund their capital commitments to venture capital funds.[89] Such defaulting LPs left venture capital funds with less cash than they had anticipated.[90] As a result, VCs were not able to fund existing and new portfolio companies.[91]

IV. CONCLUSION

The fallout from the credit crisis in the venture capital arena highlights the depth and breadth of financial market networks. The spread of the credit crisis underscores the need for risk management and regulation that focuses on better containment of the spread of financial contagion. In the venture sector, the combination of limited exit opportunities and limited partner liquidity constraints will likely lead to changes in the composition of market participants.[92] The credit crisis underscores the reality of pervasive networks in financial markets. Such networks reveal that few participants in financial markets are likely to be sheltered from the consequences of network failure, particularly if firewalls are not adequate in light of the risks taken on by financial market participants, both individually and in aggregate.

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[89] Pui-Wing Tam & Craig Karmin, *Venture Capital Hits a Cash-Call Crunch*, WALL ST. J., Dec. 8, 2008, at C1, *available at* http://online.wsj.com/article/SB122869480476586689.html.

[90] Henry Blodget, *More VC Investors Defaulting, Cash Crunch Getting Worse*, SILICON ALLEY INSIDER, Dec. 8, 2008, *available at* http://www.businessinsider.com/2008/12/more-vc-investors-defaulting-cash-crunch-getting-worse.

[91] Bailey & Gershenberg, *supra* note 122, at 2 (noting that VCs are now likely to scrutinize portfolio companies to cull companies that are expected to succeed to "focus scarce resources on their highest impact companies").

[92] *Id.* at 4-5 (projecting that the venture industry will have fewer and more diverse investment funds).